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# 2MASS OBSERVATION OF RCW 103: Evolution of young SNR in dense environment

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## ABSTRACT

Title: 2MASS Near-infrared images of RCW 103

Authors: J. Rho, B.-C. Koo, W. T. Reach, T. H. Jarrett, R. Cutri, and M. Skrutsk


We present near-infrared images of the supernova remnant RCW 103 (G332.4-0.4) from the Two Micron All Sky Survey (2MASS). In all three 2MASS bands---J, H, K<sub>s</sub>---emission is detected, revealing a barrel-shaped, shell-like morphology. However, the J and H band shells are displaced with K<sub>s</sub> band shell. The J and H band emission are mostly from [Fe II] lines while the K<sub>s</sub> band emission is mostly from molecular hydrogen, as inferred from previous near-infrared spectroscopy. The 2MASS images show that the displacement between the [Fe II] and H<sub>2</sub> is not just due to a projection effect; instead, it appears that the layers emitting [Fe II] and H<sub>2</sub> lines are intrinsically double shells.

We compared the 2MASS images with radio and X-ray images at comparable resolutions. The X-ray and radio shells coincide with the J and H band shells, while the K<sub>s</sub> band shell is located outside of the shock front. We discuss the origin of the molecular hydrogen shell in terms of a magnetic precursor or excitation by a radiative precursor. We also discuss the ISM environment of RCW 103 using physical parameters inferred from near-infrared lines.

## Images

Figure 1. RCW 3 color image

Blue (largely Fe II)



green (largely Fe II)  
red (shocked H<sub>2</sub>)

Figure 2a J band image  
Figure 2b H band image  
Figure 2c K band image

|  | median noise     | DN                | erg s <sup>-1</sup> cm <sup>-2</sup> sr <sup>-1</sup>                       |
|--|------------------|-------------------|---|
| Surface brightness                       |                  |                   |   |
| jrcw103.fits                             | 103.33 2.84      | 5-26 DN (108-129) | 1.52 $\times 10^{-4}$ erg s <sup>-1</sup> cm <sup>-2</sup> sr <sup>-1</sup> |
| 7.6-39.5 E-4 (erg/cm <sup>2</sup> /s/sr) |                  |                   |   |
| hrcw103.fits                             | 403.25 5.36      | 9-19 DN (412-432) | 0.83 $\times 10^{-4}$ erg s <sup>-1</sup> cm <sup>-2</sup> sr <sup>-1</sup> |
| 7.5-15.8 E-4 (erg/cm <sup>2</sup> /s/sr) |                  |                   |   |
| krcw103.fits                             | 472(475.03) 6.19 | 7-15 DN(479-488)  | 0.61 $\times 10^{-4}$ erg s <sup>-1</sup> cm <sup>-2</sup> sr <sup>-1</sup> |
| 4.3-9.2 E-4 (erg/cm <sup>2</sup> /s/sr)  |                  |                   |   |

## Discussion

Important issue.

- 1) Is the two layers shell, Fe and H<sub>2</sub> due to projection effect?  
(large image covering the entire remnant shows it is indeed separate two layers)
- 2). Is the two shell due to front and reverse shocks?

\*OVERLAY WITH X-RAYS

\*OVERLAY WITH RADIO.

What is H<sub>2</sub> emission which appears outer than the shock front? How was it formed?

Is it magnetic precursor (If then what is evidence for it?)

Is it radiative precursor (If then what is evidence for it?)

Morphology: Small distortion shape is seen in the south with high resolution 2MASS image.

\*\*Also I will present the comparison between Fe line predictions and H<sub>2</sub> predictions

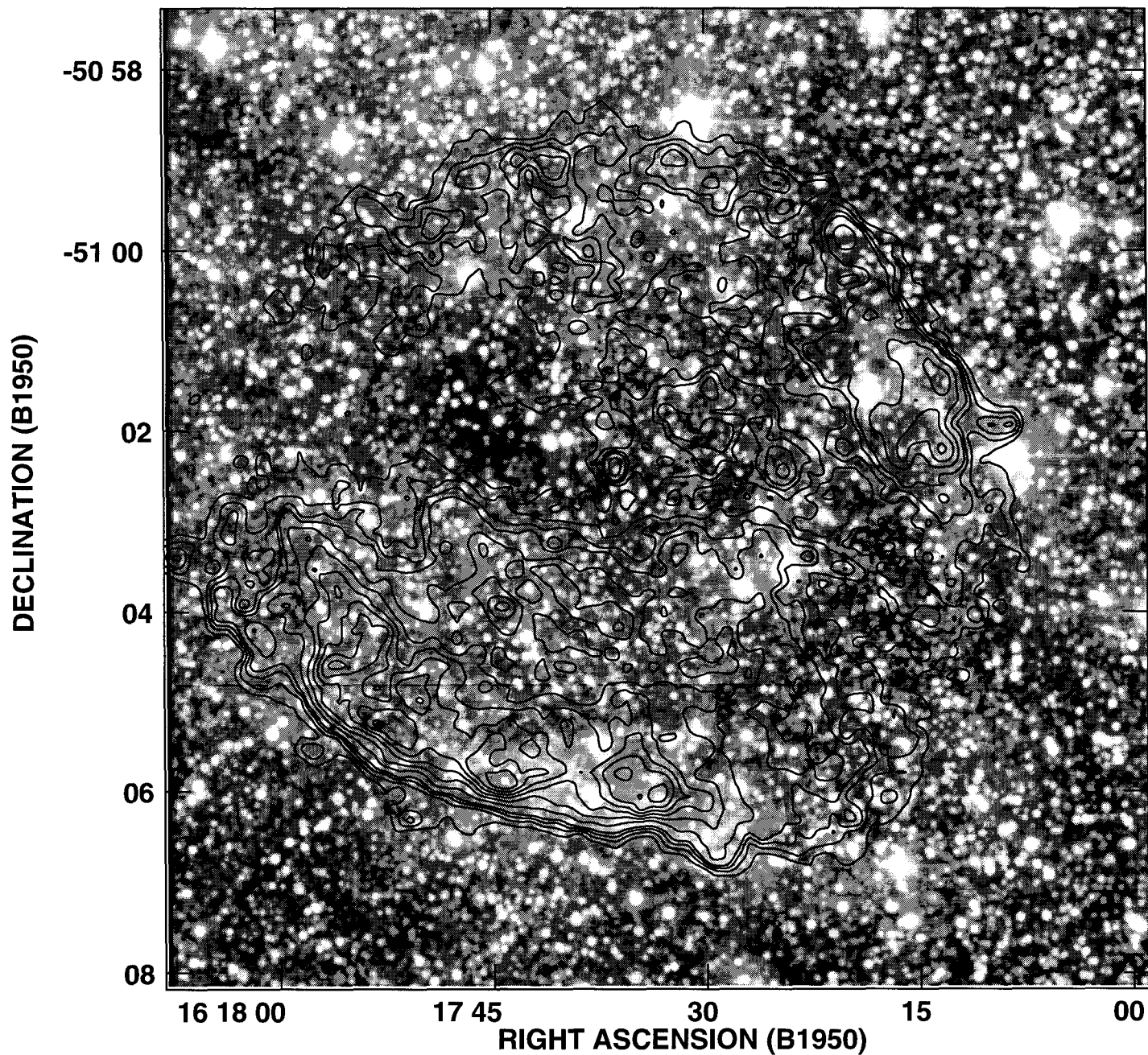
\*\*make shock model tables with Oliva et al. published data.

\*\*overlay with CO map. Dark part consistent with CO map in south?  
and also estimate the extinction.

\*\*SEARCH FOR THE PULSAR?

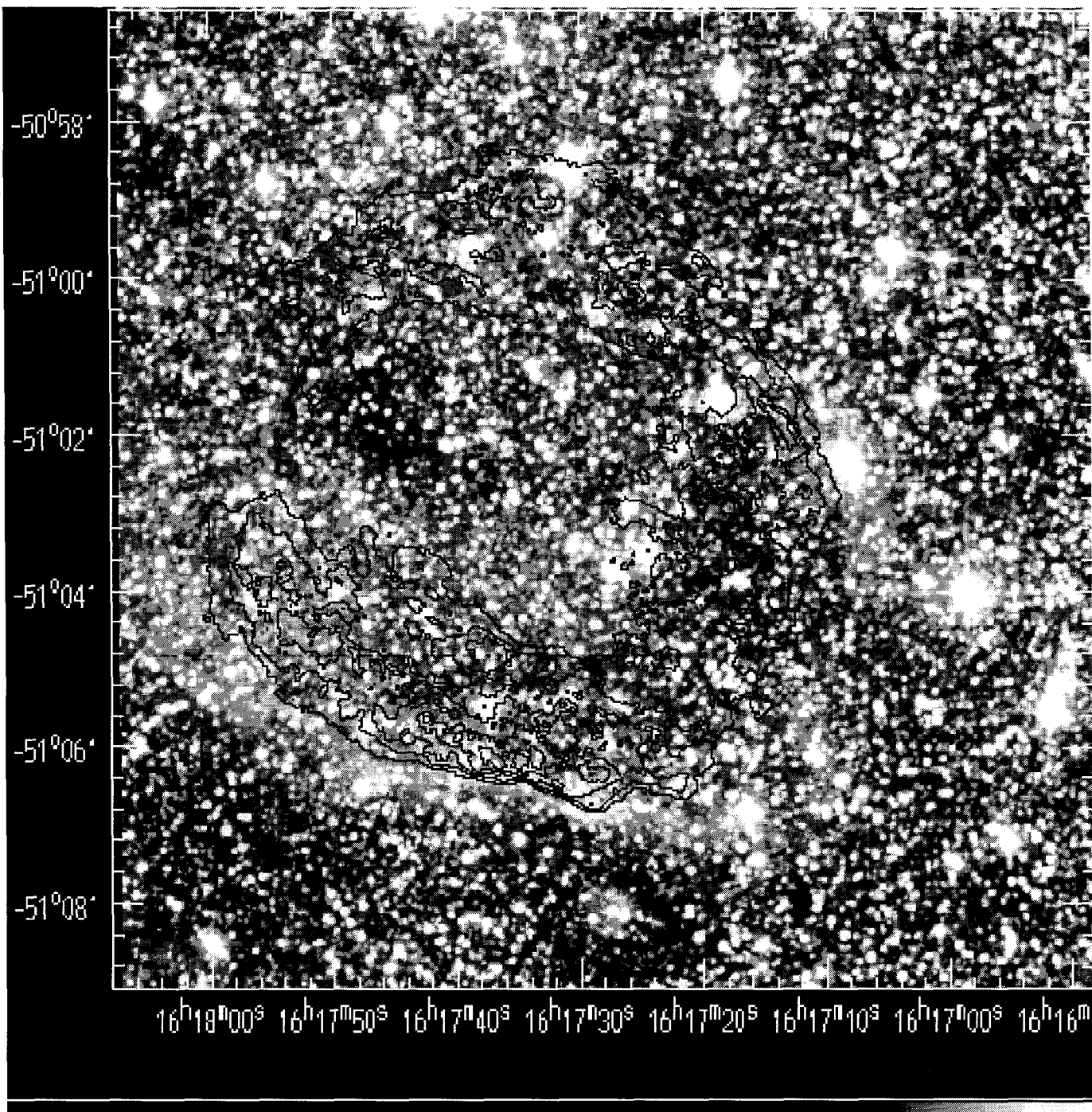
Is it detected? Any 2MASS star candidate?

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CONT: 1E 16134 1E 16134.HGEOM.1

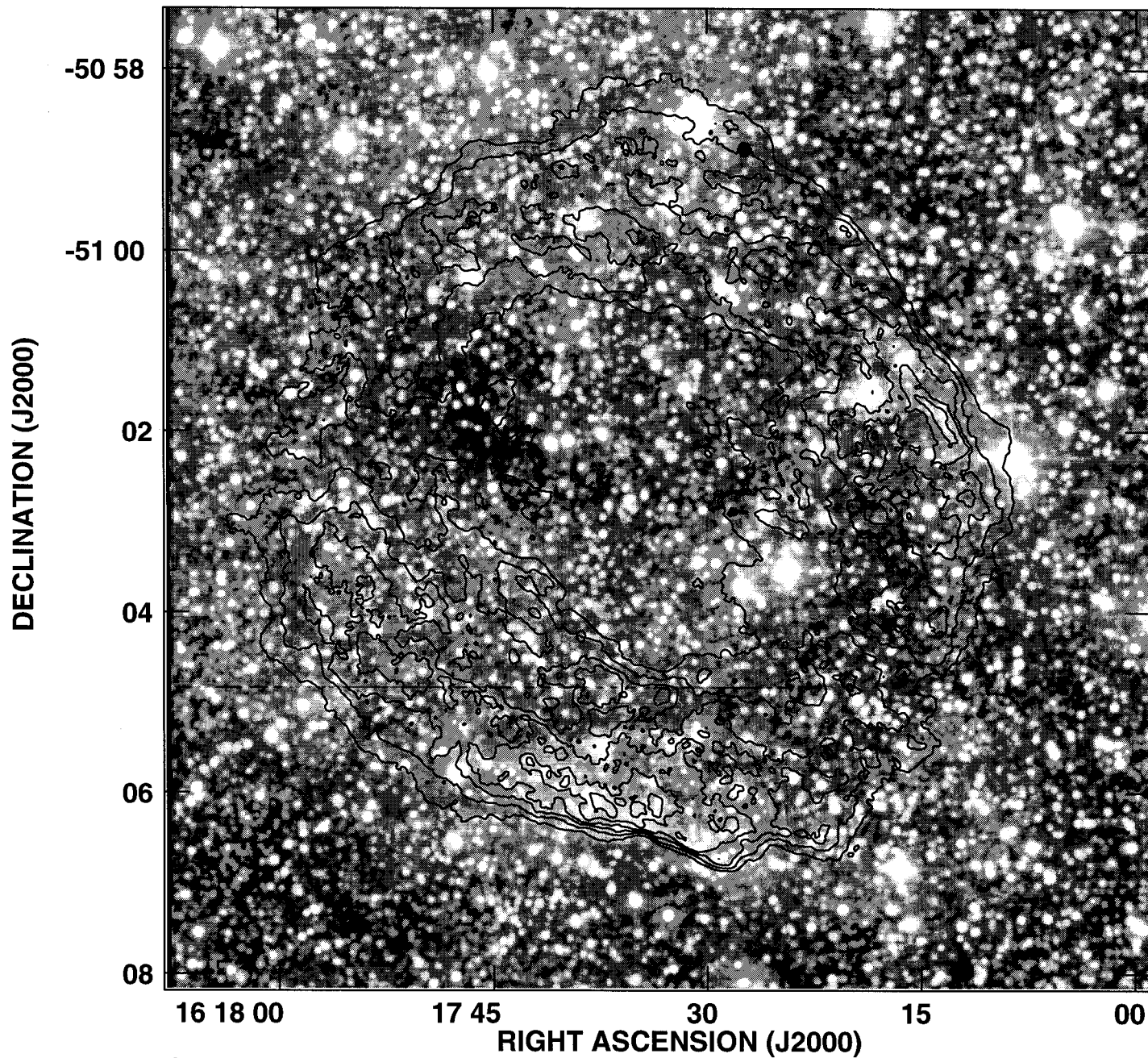


Cont peak flux =  $4.5982\text{E}+02$   
Levs =  $1.000\text{E}+01 * (4, 6, 8, 10, 15, 20, 25, 30,$   
 $35, 40)$





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CONT: rcw103 IPOL 2370.000 MHZ RCW103-13.HGEOM.1



Cont peak flux =  $1.2321 \times 10^{-2}$  JY/BEAM  
Levs =  $1.000 \times 10^{-3} \times (3, 4, 5, 6, 8, 10, 12, 14)$

